Quasiparticle scattering interference in high T_c superconductor

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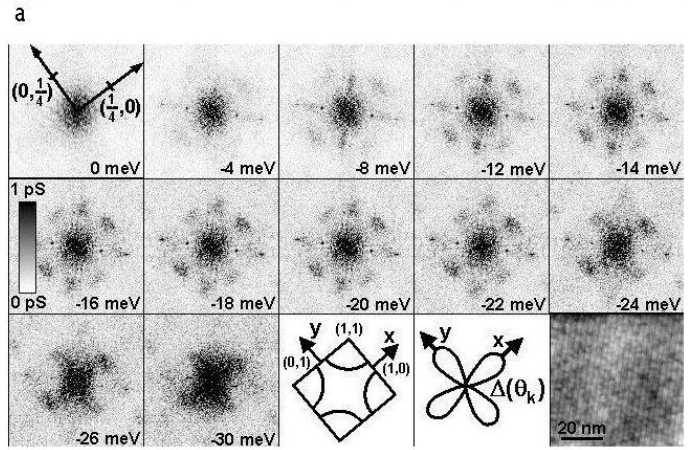
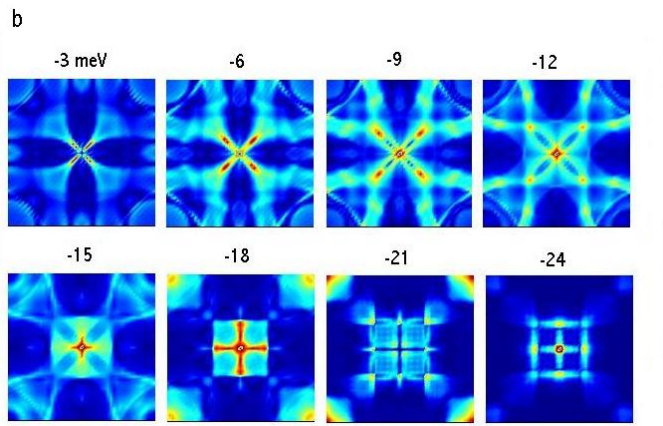
- After being scattered by impurities the quantum mechanical wave function of electrons in a normal metal exhibit interference patterns.
- In high T_c superconductors the quasiparticles are quantum mechanical mixture of electrons and holes. They exhibit a more complex scattering interference patterns.
- The inset figure in **a** show the Fourier amplitude of the electron ``tunneling density of states'' measured in recent high-resolution scan-tunneling microscope image of $Bi_2Sr_2CaCu_2O_{8+x}$. The inset figure in **b** is the theoretical prediction. (Note the orientation of the experimental result is rotated 45 degree from that of the theory.)
- The following students and researcher participated in this project: Qianghua Wang (visiting scholar), Henry Fu (graduate student)





Nano scale electronic inhomogeneity in high T_c superconductors

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- Recently it is discovered that some high T_c superconductors are electronically inhomogeneous on nanometer scale.
- The inset figure **a** is a real space map of the *Bi2Sr2CaCu2O8+x* (T_c = 65 K) superconducting energy gap in by the scan tunneling microscope. The inset figure **b** is the theoretical result using the t-J + Coulomb model to describe the copper-oxygen plane of the high T_c superconductors.
- The significance of these results is that the ``Cooper pair'' in high T_c superconductors is smaller than nanometer in size. At such length scale the repulsive Coulomb interaction between the electrons is poorly screened.
- The following postdoc and researcher have participated in this project: Jung Hoon Han (postdoc), Qianghua Wang (visiting scholar).